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Track Support

Description

The invention relates to a track support for the track of a magnetic levitation railway, consisting of a steel support, which is preferably fully welded in a fully automatic manner and has a closed hollow trapezoidal or hollow triangular cross section with closed end faces, the cover plate of which support, forming the upper chord, projects laterally, in the manner of a jib, with its longitudinal edge sections over the web plates, which form the side walls and which converge at an angle from the underside of the cover plate to the mid-vertical plane of the track support, and to each end of which cover plate a side guidance rail is attached.

The magnetic levitation railway is a track-guided transport system with non-contact levitation, guidance and propulsion technology. The levitation and guidance system works on the principle of electromagnetic levitation, which is based on the attractive forces between the lacuna in the underbody of the vehicle and the ferromagnetic reaction rails, the so-called stator packs, which are installed beneath the track. The levitation magnets attract the vehicle to the track from beneath, and the guidance magnets installed at the side hold the vehicle laterally in the track. The levitation and guidance magnets are arranged over the entire length of the vehicle on both sides. The essential element of this technology comprises the track supports forming the track, which take on the functions of support, guidance and levitation of the vehicle and transmit the loads via the main supporting framework to the bearings; from there, the loads are passed to the ground via the substructures and the foundations.

The torsionally rigid steel track supports, which are generally fully welded in a fully automatic manner and have a hollow triangular or hollow trapezoidal cross section with closed end faces, for the track of a magnetic levitation railway, consisting of a cover plate with a thickness of from 15 to 25 mm, which forms the upper chord and to which the web plates having a thickness of from 10 to 20 mm, which form the side walls and which converge at an angle to the mid-vertical plane of the track support, are connected in a downward direction. In the case of the track support with a hollow triangular cross section, the lower chord consists of a tube, and in the case of the track support having a hollow trapezoidal cross section, the lower chord consists of a base plate with a thickness of from 30 to 50 mm. The longitudinal edge sections of the cover plate, which project over each of the side wall web plates in the manner of a jib, are stiffened by cross-supports or bulkheads installed at intervals and at the same time serve to connect the functional components corresponding to the levitation and guidance system of the vehicle, essentially consisting of stator packs with cable windings and the guidance rails, which are connected via anchoring supports to double-T supports attached to the jibs (ref.: Eisenbahntechnische Rundschau, ETR 33, 1984, issue 6, pp. 487 to 492, in particular pp. 488/89).

Based on this prior art, DE-C-19735471 discloses a track support in which the side guidance rails are mounted directly at the ends of the cover plate jibs projecting over the lateral side wall web plates. The stator packs with a length of about 1 m, which consist of plastic-bonded and encapsulated electric steel plates are arranged on both sides of the track support beneath the jibs along the entire track. Via three grooved cross members, which are bonded in an interlocking manner in the jib-facing side of each stator pack, these stator packs are attached, in each

case by means of two bolts, to the stator support chord, which is connected to the stator support web, which is arranged on the underside of the jib and runs parallel to the mid-vertical plane of the track support. The grooved cross members and the grooves accommodating these in the stator support chord form a redundant attachment in addition to the bolt.

Since the function and operational strength of the track supports forming the track must be guaranteed for the service life of at least 80 years, all surfaces of the track support have to be automatically blasted and cleaned in accordance with DIN 55928, Part 4, with a standard cleanliness of SA 2 ½ or greater by means of one or more freely programmable handling devices. A primer coat of zinc dust and three further coats of iron mica are subsequently applied to the surfaces prepared in this way by means of one or more freely programmable handling devices. In order to meet the requirement for a service life of 80 years, maintenance and inspection, where necessary together with repair work of the track, is necessary at regular intervals.

The object of the present invention is to keep the surfaces of the track support described at the outset which are exposed to environmental influences as small as possible with optimized use of materials and to simplify and qualitatively improve the attachment of the stators.

This object is achieved by a combination of features indicated in Claims 1, 4 or 7.

Claims 2, 3, 5, 6, 9 and 10 preferably give embodiments of the combinations of features according to the invention.

The invention is explained in greater detail below by means of illustrative embodiments,

in which:

Fig. 1 shows a cross section through a track support.

Fig. 2 shows an enlarged partial section of the track support design in the region of the jib shown in Fig. 1

Fig. 3 shows an enlarged depiction of detail X in Fig. 2

Fig. 4 shows an enlarged partial section of the track support design modified compared with Fig. 2 in the region of the jib.

Fig. 5 shows an enlarged partial section of the track support design modified compared with Fig. 2 in the region of the jib.

The torsionally rigid steel track support (1), which is fully welded in a fully automatic manner and which has a closed hollow trapezoidal cross section, consists of a cover plate (2), which forms the upper chord, the web plates (4, 5), which form the side walls, are mounted on the underside of the cover plate (2) and converge at an angle to the mid-vertical plane (3) of the track support (1), and the base plate (6), which is connected to the web plates at the bottom and forms the lower chord. The longitudinal edge sections of the cover plate (2) project laterally over the web plates (4, 5) in the manner of a jib (7, 8) and carry at their ends in each case a side guidance rail (9, 10). A stator support web plate (11, 12), which runs parallel to the mid-vertical plane (3) of the track support (1), is mounted on the underside of each jib (7, 8) beneath the set-down zone of the jib (7, 8), and horizontal plates (13, 14, 15, 16), by means of which the cavities (17, 18, 19, 20) are closed on the ground side, are arranged between the end of the web plate on the ground side and

the adjacent side wall web plate (4, 5) on the one hand and the adjacent side guidance rail (9, 10) on the other hand. Two web flanges (23, 24, 25, 26), which run parallel to the vertical load plane (21, 22) passing through the set-down zone and at the same distance from the vertical load plane, and between which the stator packs (27, 28) are attached, are located on the underside of each plate (13, 14, 15, 16). The stator packs (27, 28) are provided with three cross grooves on the jib side, into each of which a grooved cross member (29) is inserted and connected to the web flanges (25, 26) in a frictional and interlocking manner by means of a high-strength bolt (30, 31). The bolts (30, 31) inserted through corresponding holes (32, 33) in the web flange (25, 26) are screwed in the through holes (34), running perpendicular to the web flanges (25, 26), with internal thread of the grooved cross members (29). A redundant attachment of the grooved cross members (29) takes place through fixing pins (35, 36), which are arranged above the bolts (30, 31) in the vertical plane including the latter, are pressed into the holes (37) (38) located in the web flanges (25, 26) and project into the blind holes (41, 42) located in the grooved cross member with formation of an annular space (39, 40). As additional security against the falling-out of fixing pins (35, 36) which may have been loosened, washers (43) (44) are installed beneath each of the heads of the bolts (30, 31) and cover a segment of the holes (37, 38) located in the web flanges (25, 26) for the fixing pins (35, 36). In the event of both bolts (30, 31) failing, the stator pack accordingly drops by about 2 mm until the fixing pins (35, 36) are locked in the blind holes (41, 40).

A modification of the above-described fitting of the track support (1) consists, according to Fig. 4, of two stator support web plates (45, 46) attached to the underside of each jib (7, 8) and running parallel at a distance from one another and from the mid-vertical

plane (3) of the track support (1), between the ground-side end sections of which plates, which are screwed in an interlocking and frictional manner, as shown above in detail, to the grooved cross members (29), which are inserted into the jib-side cross grooves of the stator packs (27, 28) and support the latter. The cavities (47) (48) present between the side wall web plates (5) and the respectively adjacent stator support web plate (45) on the one hand and the side guidance rails (10) and the respectively adjacent stator support web plate (46) are closed on the ground side by plates (49, 50) attached to the mid-vertical plane (3) of the track support (1). It is not shown in the drawing that the cavity (51) present between the stator support web plates (45, 46) above the grooved cross members (29) can also be closed by attachment of a corresponding plate.

A further modification of the embodiment shown in Fig. 1 to Fig. 3 of the fitting of the track support (1) consists, as shown in Fig. 5, in that two stator support web plates (52, 53) are attached to the underside of each jib (7, 8) in the region beneath the set-down zone and form an angle of 15° to the mid-vertical load plane (22) running through the set-down zone and the grooved cross members (29), which are inserted into the jib-side cross grooves of the stator packs (27, 28) and support the latter, are screwed in an interlocking and frictional manner between the ground-side end sections of these plates. In accordance with the angle of the two stator support web plates (52, 53) formed with the mid-vertical load plane (22), the front faces of the grooved cross members (29) are inclined at an angle of 75°. The cavities (54, 55) present between the web plates (4, 5) and the respectively adjacent stator support web plates (52) on the one hand, and the side guidance rails (9, 10) and the respectively adjacent stator support web plates (53) on the other hand are closed on the ground side by

plates (56, 57) attached perpendicularly to the mid-vertical plane (3) of the track support (1). The cavity (58) enclosed by the two stator support web plates (52, 53) is closed by a plate (59) attached above the grooved cross members (29).

The advantages achieved by means of the device according to the invention are to be regarded, in particular, as being that, with optimized use of materials, the surfaces of the track support which are relatively difficult to access are not subject to environmental influences. The qualitatively better attachment of the stators is possible with significantly less effort.